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1. Type your name at the top of this document and then Save this file on your H: drive or on a flash drive so you can access it again if you don’t finish today.
2. Click on the link: <http://www.colorado.edu/physics/phet/web-pages/index.html>
3. Click on *Play with sims*, then find *Wave on a string*, click on it and then select *Run now*. You should now see a virtual string wave lab. Follow the instructions below, typing in your answers to any questions directly into this word document. Post it on your Wiki. Send me the link through the discussion forum on the WAVES page on the physics Wiki.
4. Wave aspects: Select Pulse mode and click on pulse. Experiment with the various controls. Describe the changes to the wave pulse when you vary each of the 4 controls: amplitude, pulse width, damping, and tension.

Amp. Control controls the height of the waves. Pulse width determines how long the pulse is. Damping control causes the waves height and width to decrease over the wave. The tension control determines how close together particles are together.

1. Using pulse mode, set the tension to high and lower the damping to 1. What happens to a single pulse when it reflects from the 3 different ends: stiff end, loose end, no end.

Fixed end: the pulse travels back and forth with a decreasing amount of energy. Loose end the pulse rises up and down on the loose end. No end, the pulse goes across once, but then stops movement.

1. Colliding pulses: Set the damping to zero. Using a stiff end, send one pulse then another when the first one starts to reflect. What happens when two opposite pulses collide (as in diagram)? Try it several times. You can use the reset button to clear it. Use the pause and step buttons to help you see it in slow motion. Especially note what happens when the 2 pulses are exactly superimposed.

When the pulses meet, they break and energy increases the speed.

1. Now repeat the above collision experiment using a loose end. What happens when two pulses on the same side collide?

The end of the wave moves up and down on the pen and eventually move off of the top and bottom.

1. Wave speed: Set tension on high and damping zero. Now click on the timer and ruler and determine the velocity of a single pulse. Experiment and see which of the 4 wave controls affects the wave speed. How (increase or decrease?)

The wave is almost a meter long and takes 2.3 seconds to complete. Velocity is 0.435 meters per second. The amplitude increases the speed. The damping decreases the speed.

1. Standing Waves: Set the amplitude down to 5, and the damping to zero, tension high, fixed end. Select the oscillate mode. Watch the standing waves for a few minutes. Describe what happens to the amplitude. How is this an example of Resonance? What happens if the driving frequency is slightly off? (Try setting f = 49, and f = 51). Resonance causes a change in oscillation at different frequencies. The shape of the wave changes also at changing frequencies.
2. Use the pause and step buttons to see what the standing wave looks like at various points. Where is the wave energy when it’s flat?

The wave is never truly flat.

1. The initial frequency display is 50 units. Is this 50 Hertz? How can you tell? Use the timer to time 10 complete vibrations and the then calculate the frequency in Hz.

Yes, because the unit for frequency is measured in Hertz. 50 Hertz.

1. How many whole wavelengths are there? Compute the wavelength in meters.

4. Tenth of a meter each.

1. Compute the velocity using the wave equation: v = fλ. Why should your answer be similar to your result in step 8?

40 Hz, this is similar to the response in answer 8, because it does not change.

1. Harmonics: If this were a string instrument, which harmonic is shown?

The second harmonic, since it vibrates up and lightly touches the wave, then comes back down.

1. Find the frequency setting (not in Hertz) that produces the first harmonic (as drawn in Friday’s notes.) Then find it for the 2nd and 3rd harmonic. What is the pattern here?

The 25 unit Hz creates a 3rd harmonic. The 19 unit Hz creates the 2nd harmonic. The Hz increases as the harmonic number increases.

1. Now set the frequency to 12 and select loose end, then click on reset. Wait a while until you can identify the standing wave pattern. To which Harmonic series does this belong? Which harmonic is it?

This is the second harmonic and of the natural harmonics series.

1. Now find the frequency setting needed to produce the next 2 harmonics in this series. Name them and the frequency setting you used. What is the pattern here?

15 for the next harmonic and 17 for the next one.

1. Try making standing waves with the *No end* setting. Explain your observations.

The standing waves are made with a frequency of 27 in the 3rd harmonic